

Title: A New Technique for Furnace Exit Gas Temperature Measurement and Its Application to Post-Combustion NO_x Reduction Processes

Co-Authors: Peter Kirby
Daniel T. Menniti

E-mail address: Peter.kirby@landinstruments.net
daniel.menniti@ landinstruments.net

Telephone No.: 215 781-0810

Fax No.: 215 781-0798

Affiliation: Land Instruments International

Address: 2525 Pearl Buck Road
Bristol, Pa 19007

Summary

A New Technique for Furnace Exit Gas Temperature Measurement and Its Application to Post-combustion NO_x Reduction Processes

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Peter Kirby

Daniel T. Menniti

In the combustion process, the furnace exit gas temperature (FEGT) is a key parameter to determine the rate of formation of NO_x emissions. FEGT is also one of the key criteria for the design and operation of process control systems for post-combustion NO_x reduction technologies. Currently, the methods being used for this parameter have been through the use of water cooled high temperature velocity probes, ultrasonic modeling or spectral analysis.

The LanTemp FEGT monitor has been designed utilizing the latest application of infrared thermometry. The thermometer operates in a waveband which views the furnace exit gas as an opaque object, thereby collecting the radiation emitted from the furnace exit gas and providing a temperature output to the plant digital control system.

SNCR Applications

The FEGT Monitor has several applications in the power utility industry. In particular, the technology is applied for use on post-combustion NO_x removal processes. If a power utility boiler uses an SNCR technique, there is a temperature window that must be maintained for the most efficient operation of the NO_x removal process.

Typically, this temperature window is between 1600 to 2300°F. However, as newer techniques are being developed, this window may change. One example of the temperature window for Amine Enhanced Fuel Lean Gas Reburn was reported in the 25th International Tech Conference on Coal Utilization & Fuel Systems¹. In this case the window under oxidizing conditions was only 200°F (1800-2200°F). This window can be widened to 2500°F when the oxygen levels are very low¹.

Since the temperature window is related to other parameters in the process, a continuous measurement of FEGT is desirable. Typically the FEGT is monitored during the commissioning of an SNCR system, and then periodically checked during normal operation. The periodic FEGT has been traditionally measured using High Velocity thermocouples (HVT's or Suction Pyrometer's). This technique, while extremely accurate, can only be used for periodic monitoring.

Other on-line techniques incorporate very sophisticated infrared diode array measurements. This type of measurement can be made on a continuous basis. The technique relies on the temperature of the ash particles in the furnace exit gas, and hence, cannot be applied to a natural gas fired boiler.

Additionally, the plant operators rely on Computational Fluid Dynamics(CFD) tools to provide information on the changing furnace conditions.

LanTemp Technique

The LanTemp is a very simple, yet application specific device. The system provides all of the ambient environmental and process protections required for the application where it is installed. Examples include an air purged housing and rugged optical protection, via fully-automatic shutters. The system has a standard current loop output for the measuring range of 750-3000 °F.

Technologically, the system has been designed to rely solely on the changes in the furnace exit gas temperatures, by measuring the exit gas itself. When selecting the operational wavelength, we ensured that the system operated outside of the waveband which would detect the ash particle radiation and hence, is not affected by the fuel type or particulate loading of the furnace. Additionally, this technique would then eliminate any changes in temperature measurements based on ash emissivity.

REFERENCES

- ¹ "Commercial Design Development of Amine Enhanced Fuel Lean Gas Reburn (AEFLGR®) for NO_x Reduction in Electric Utility Power Boilers"
- Joseph R. Comparato, 25th International Tech Conference on Coal Utilization & Fuel Systems.